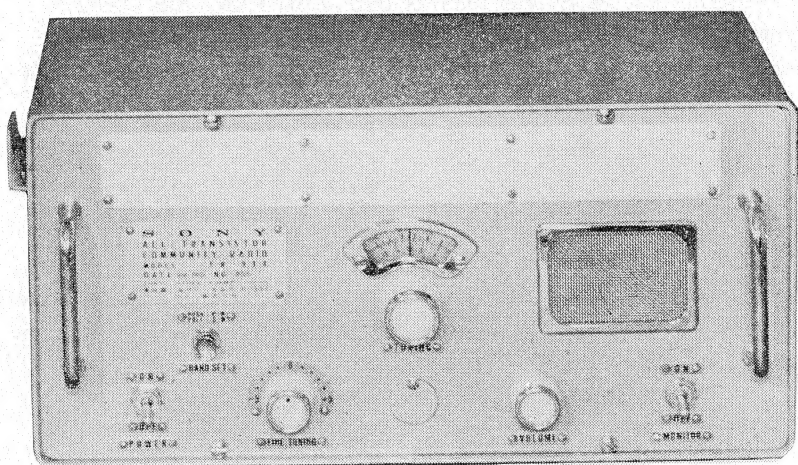


SONY

SERVICING GUIDE

TR-903



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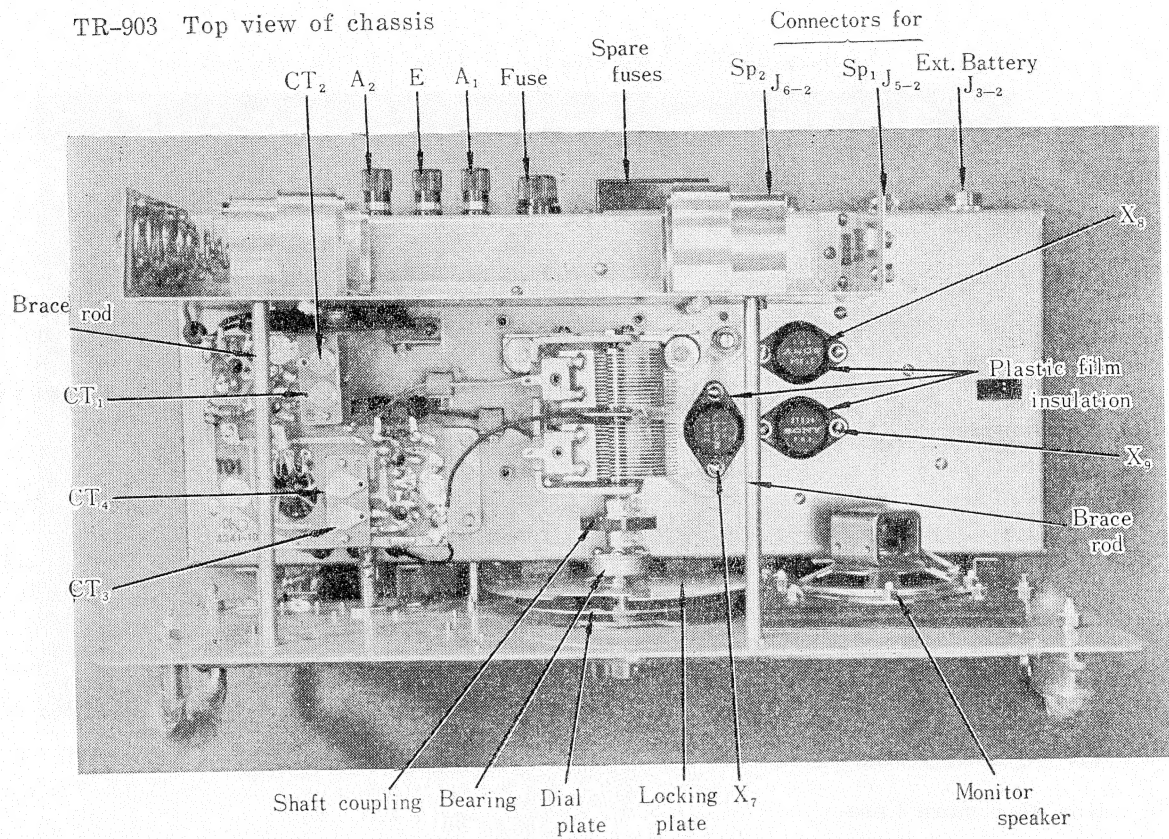
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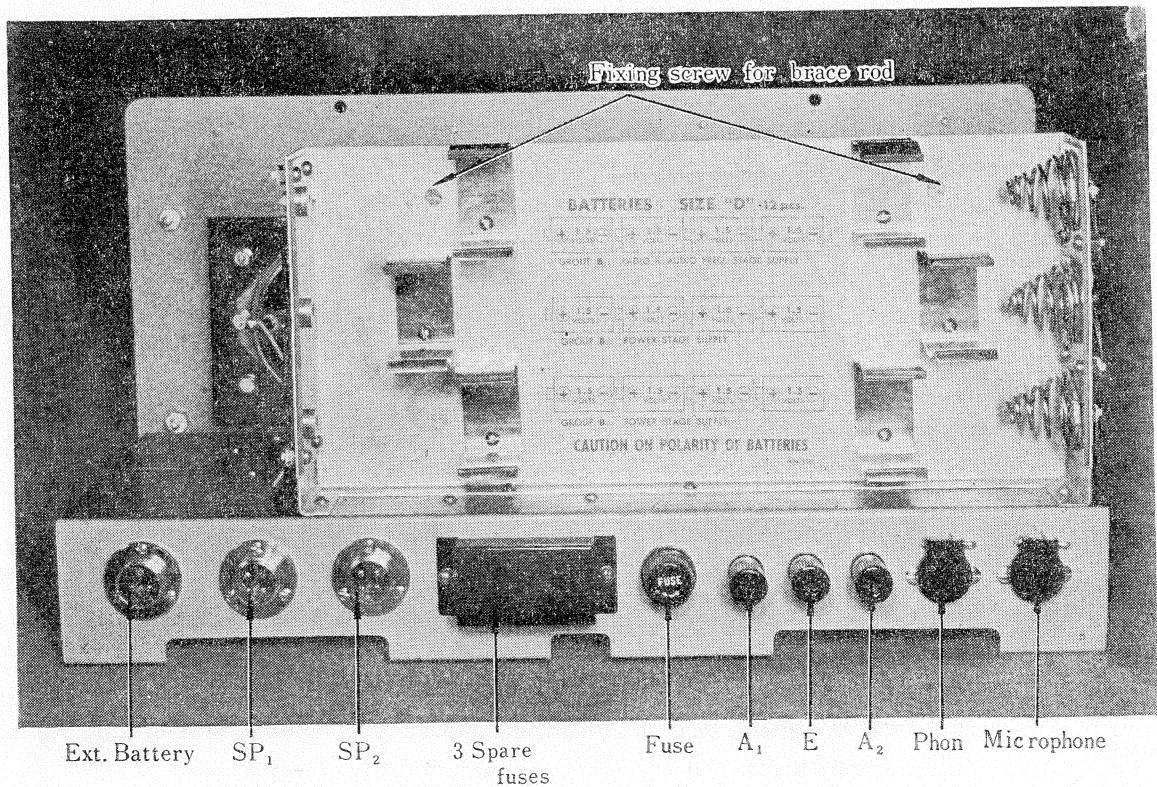
Specifications for TR-903

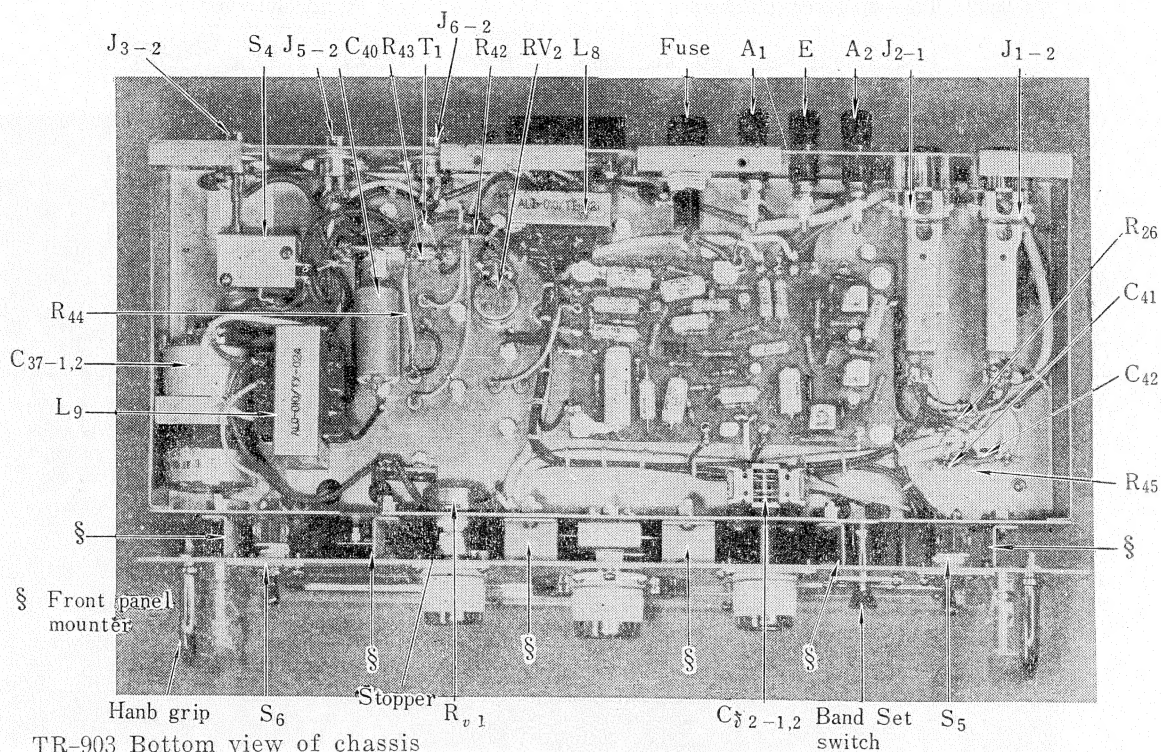
Circuit	: 9 transistor Superheterodyne (including 1 transistor for microphone amplifier)
Covering frequency	: MW 535~1605 kc SW 3.9~12 Mc
IF frequency	: 455 kc
Sensitivity	: 100 μ V/m for 1 Watt output
S/N ratio	: Better than 20 dB at field intensity of 100 μ V/m
Selectivity	: Better than 20 dB at 10 kc off
Undistorted	
output power	: 1.5 Watts
Maximum output power	: 3 Watts
Output load	: 4 Ω
Input impedance	: 10 k Ω for Microphone jack and Phone jack
Frequency response	: 300~3,000 cps within 6 dB
Self-contained battery	: 12 size "D" flashlight batteries divided into 3 groups B1, B2 and B3
	Group B1 4 batteries for radio tuner and voltage amplifier (6 Volts)
	Group B2 & B3 Each 4 batteries for power amplifier stage (6 Volts)
External battery	: 6 Volt storage battery of more than 18 AH can be used It saves battery life of group B2 and B3.
Current drain	: B1 50 mA B2 & B3 30 mA without signal 650 mA at 1.5 Watt output 950 mA at 3 Watt output
Battery life	: B1 more than 100 hours B2 & B3 " " 15 hours
Minimum operative	
battery voltage	: 4.5 Volts
Dimensions	: 7.5"H \times 15.5"W \times 8.5"D (190 mm \times 394 mm \times 215 mm)
Weight	: Approx. 23 lbs. including batteries (5.8 kgs)
Microphone	: Sony F-7 dynamic microphone
	Impedance 10 k Ω
	Frequency response 60~10,000 cps within 10 dB
	Sensitivity -60 dB/1 μ bar (0 dB: 1 Volt)
Horn speaker	: Two 12" re-entrant horns with compression type driver units
	Maximum input 10 Watts
	Moving coil impedance 8 Ω
	Diaphragm Phenolic
Attached cord	: 66' rubber jacket cable
External battery cord	: 6' rubber jacket cable
Antenna	: All wave doublet antenna and 100' 300 Ω feeder wire (available as optional accessory)
Permissive temperature of this set during operation is 40°C (104°F)	

TR-903 Top view of chassis



TR-903 Back side view of chassis





TR-903 Bottom view of chassis

How to remove Case

- (a) Take out batteries.
- (b) Loosen 2 screws on the bottom and remove them.
- (c) Place the set back side down.
- (d) Loosen 4 fixing screws on the Front panel.
- (e) Lift the chassis gently by holding Hand grips.

How to take off components for replacement

- (1) Tuning condenser CV_{1-1,2}
 - (a) Unsolder 3 wires.
 - (b) Loosen 2 set screws (condenser side) on the shaft coupling.
 - (c) Loosen 2 mounting screws. The condenser will be dismantled together with Mounting angle.

Required tools: Soldering iron, 3 mm screw driver

- (2) Volume control RV₁
 - (a) Unsolder 3 wires.
 - (b) Take off the knob by loosening set screw.
 - (c) Loosen 2 set screws for stopper.
 - (d) The Volume control can be dismantled by loosening nut.

Required tools: Soldering iron, screw driver of 2 mm or 3 mm, 6 mm wrench

- (3) Fine tuning condenser CV_{2-1,2}
 - (a) Unsolder 3 wires.
 - (b) Take off the knobs for the Tuning condenser, the Volume control and the Fine tuning condenser.

- (c) Remove Band switch button by taking off 2 securing screws.
- (d) Loosen and take off nuts for Power switch and for Monitor switch.
- (e) Loosen and take off 2 fixing screws for Brace rod on the wall plate of Battery compartment.
- (f) Loosen and take off 10 securing nuts for Front panel mounters (6 pieces).
By doing this the Front panel will be separated from the chassis.
- (g) Loosen and take off 3 fixing screws. The Fine tuning condenser will be dis-mounted.

Required tools: Soldering iron, 2 mm screw driver, 4 mm wrench, 6 mm wrench

(4) Micro-switch S₄

- (a) Unsolder 4 wires from the switch and 2 wires from External battery connector J₃₋₂.
- (b) Loosen 3 fixing screws for External battery connector J₃₋₂. The Micro switch will be dismounted together with mounting bracket. Be careful not to lose spring and push rod.

Required tools: Soldering iron, 3 mm screw driver

Power transistor 2T303 and 2T304 (used in driver and power amplifier stages)

The construction of the power transistor differs from that of ordinary one.

The collector side of its element makes Ohmic contact with "Header" (or Shell) of the transistor in order to dissipate heat easily. Therefore, the Header itself works as a collector lead; the current is fed through one of 2 fixing screws.

This construction permits the heat to be conducted to metal chassis to which the transistor is mounted. Thus the heat is dissipated through larger surface of metal chassis.

In actual use, a thin plastic film is inserted between the transistor and the chassis for electrical insulation. 2 fixing screws are also insulated by bushings.

Be careful not to throw away the insulating materials when 2T303 or 2T304 is to be replaced.

After mounting new one, confirm the insulation between the transistor shell and the chassis.

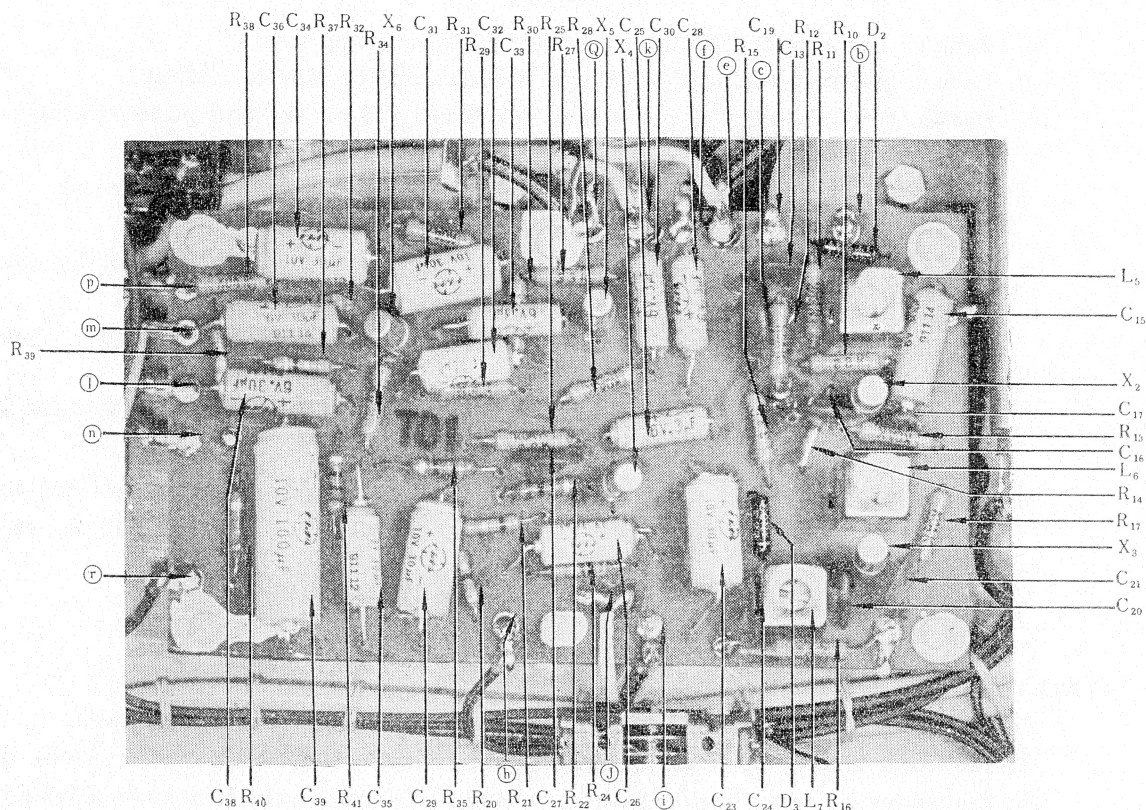
Alignment procedures

(1) Required instruments

- (a) Signal generator
- (b) AC voltmeter with full scale of approx. 5 Volts (used as an output meter)
- (c) Multi-meter
- (d) Tools

(2) Preparation

- (a) Remove the case of the set.
- (b) Connect one horn speaker to the set.
- (c) Connect AC voltmeter (1. a) across secondary winding of output transformer L₉ (terminal 7 and chassis).
- (d) Set Monitor switch at "ON"
- (e) Set Fine tuning condenser at "O"



TR-903 Printed circuit board Mounted side (IF, AF Section)

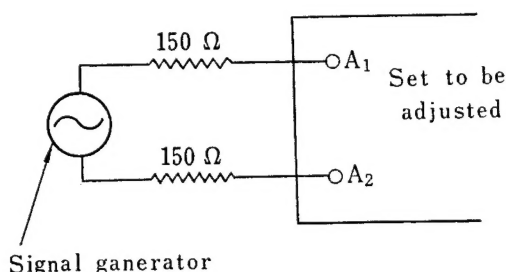
(3) IF alignment

- (a) Connect signal generator to X₁-base through 0.1 μ F capacitor. The ground side terminal of the signal generator must be connected to terminal E₁ of the set.
- (b) Set the Band switch of the set at "MW."
- (c) Turn on the Power switch of the set.
- (d) Detune the set from every station.
- (e) Adjust the signal generator to deliver 455 kc. The signal level must be kept low enough to prevent starting of AGC action.
- (f) Adjust core of IFTs L₅, L₆ and L₇ to obtain maximum output.

(4) MW tracking adjustment

- (a) Change the signal wire from X₁-base to Antenna terminal A₁. In this case 0.1 μ F capacitor must be replaced with 680 Ω resistor.
- (b) Set the Tuning condenser at minimum and adjust the signal generator to deliver 1650 kc.
Adjust Trimmer condenser CT₃ to obtain maximum output.
- (c) Set the Tuning condenser at maximum position and adjust the signal generator to deliver 520 kc.
Adjust core of Oscillator coil L₃ to obtain maximum output.
- (d) Repeat processes (b) and (c) 2 or 3 times until correct adjustment is achieved.
- (e) Adjust the signal generator to deliver 1400 kc and turn the Tuning knob of the set to receive the signal.
Adjust Trimmer condenser CT₁ to obtain maximum output.

- (f) Adjust the signal generator to deliver 620 Kc and turn the Tuning knob to receive the signal. Adjust core of Tuning coil L_1 to obtain maximum output.
- (g) Repeat the processes (e) and (f) 2 or 3 times until satisfactory result is achieved.
- (5) SW tracking adjustment
- (a) Change the connection between the set and the signal generator as follows. Connection to the chassis of the set is not required.



- (b) Set the Band switch at SW.
- (c) Set the Tuning condenser at minimum and adjust the signal generator to deliver 12.5 Mc.
Adjust Trimmer condenser CT_4 to obtain maximum output.
- (d) Set the Tuning condenser at maximum and adjust the signal generator to deliver 3.85 Mc.
Adjust core of Oscillator coil L_4 to obtain maximum output.
- (e) Repeat the processes (c) and (d) until satisfactory result is achieved.
- (f) Adjust the signal generator to deliver 10.5 Mc and turn the Tuning condenser to receive the signal.
Adjust Trimmer condenser CT_2 to obtain maximum output.
- (g) Adjust the signal generator to deliver 5 Mc and turn the Tuning condenser to receive the signal.
Adjust core of Tuning coil L_2 to obtain maximum output.
- (h) Repeat the processes (f) and (g) until satisfactory result is achieved.

Cautions:

- (a) Signal level must be kept low enough to prevent starting of AGC action.
- (b) Adjustment must be performed carefully not to be confused by image frequency.
- (c) Volume control must be set at maximum during adjustment.

Voltage and Current distributions

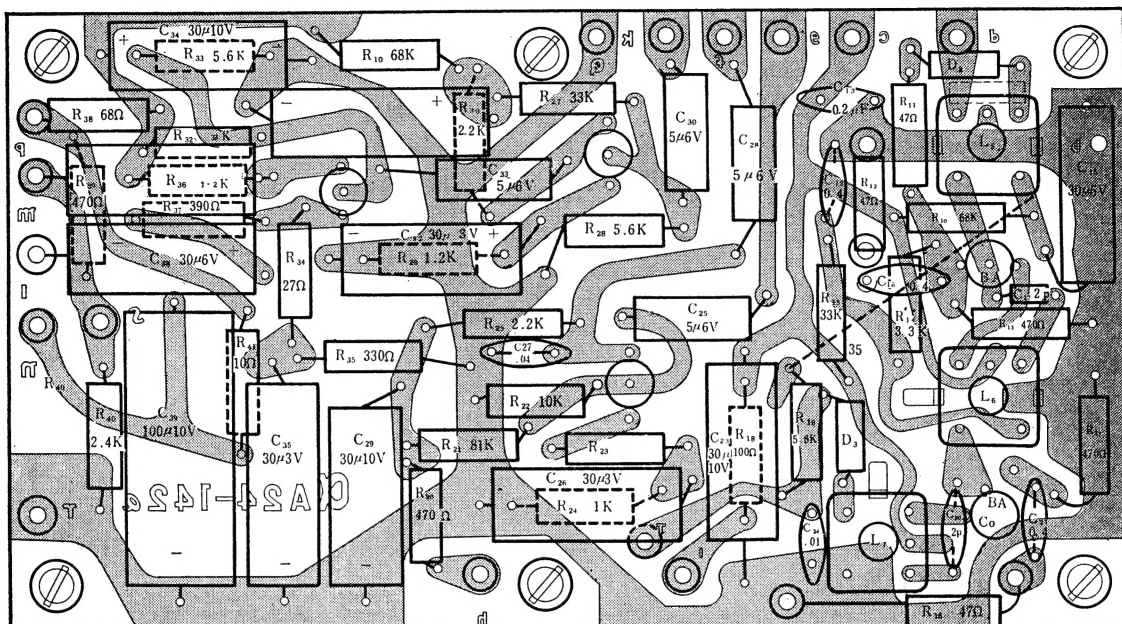
Voltage between the transistor and the negative pole of the battery in Volt

	X_1	X_2	X_3	X_4^*	X_5	X_6	X_7	$X_{8,9}$
C	0	5.7	5.7	5.0	4.6	4.0	0	0
B	5.4	0.4	0.6	0.7	0.9	0.7	5.3	5.8
E	5.5	0.3	0.4	0.5	0.7	0.6	5.5	6.0

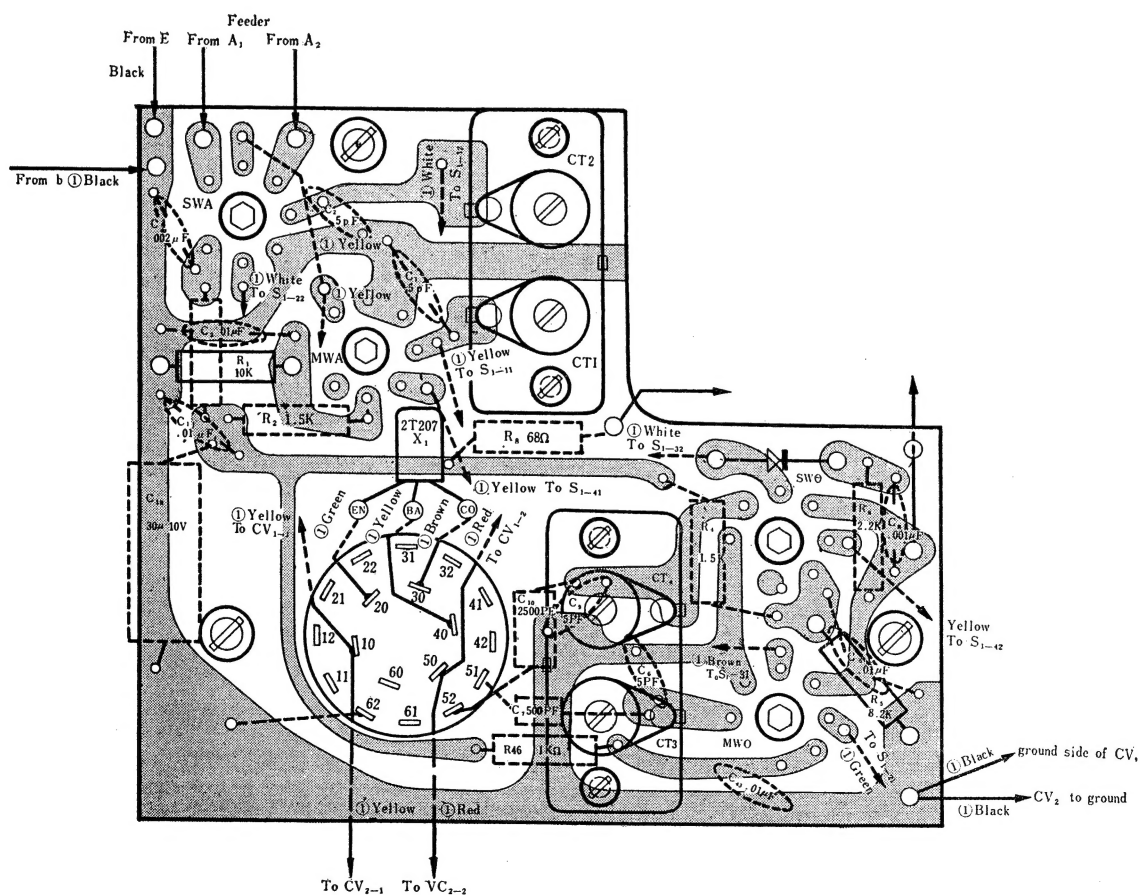
* With the Microphone plug inserted to the Microphone jack

Battery current at 0 signal: Group B_1 Approx. 55 mA when the Radio section is "ON"
 Group B_2 & B_3 Approx. 40 mA

Local oscillator voltage : MW 0.05 V~0.15 V across terminals 5 & 6 on L_2 (by VTVM)
 SW 0.05 V~0.15 V across terminals 5 & 6 on L_4 (by VTVM)

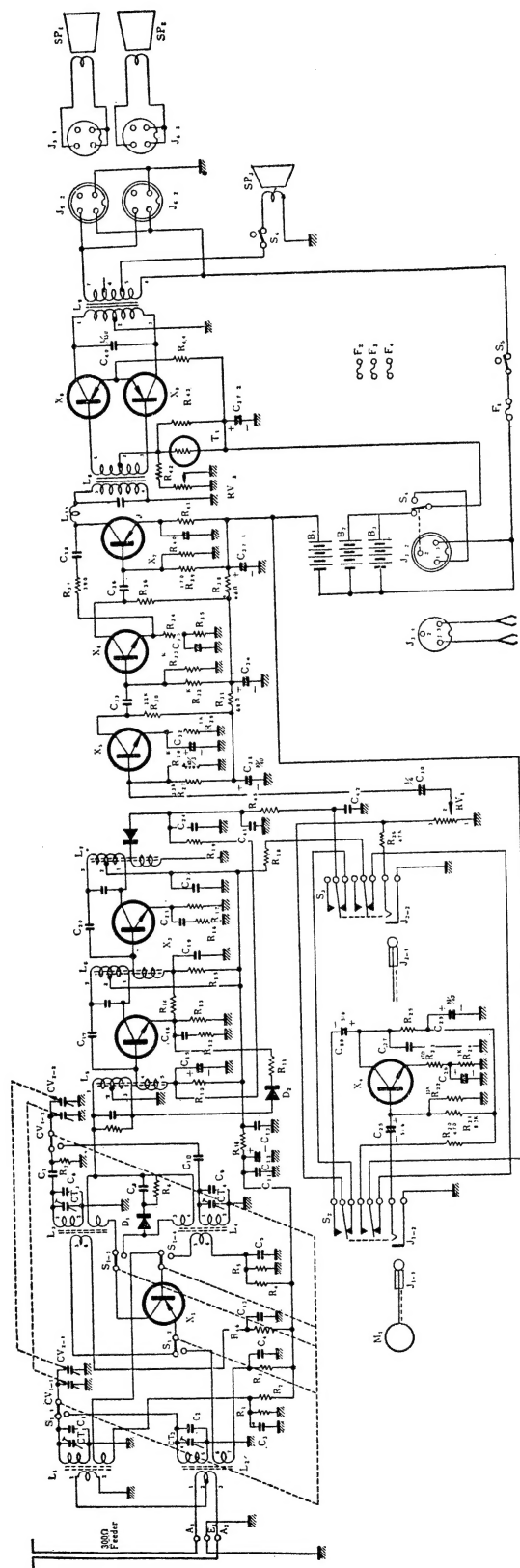


TR-903 Mounting diagram of IF and AF section



TR-903 Mounting diagram of Coil pack

Parts Symbol	Description	Parts Symbol	Description	Parts Symbol	Description
A ₁	Terminal for doublet antenna	CT ₁	Trimmer	R ₁₆	RD 1/8 p 47 ohms 10%
A ₂	Terminal for doublet antenna	CT ₂	Trimmer	R ₁₇	RD 1/8 p 470 ohms 10%
B ₁	Battery size "D" 1.5 V×4	CT ₃	Trimmer	R ₁₈	RD 1/8 p 100 ohms 10%
B ₂	Battery size "D" 1.5 V×4	CT ₄	Trimmer	R ₁₉	RD 1/8 p 5.6k ohms 10%
B ₃	Battery size "D" 1.5 V×4			R ₂₀	RD 1/8 p 470 ohms 10%
Capacitors		CV ₁₋₁	Tuning Condenser	R ₂₁	RD 1/8 p 82k ohms 10%
C ₁	Styrol 5 mmfd ±1 mmfd	CV ₁₋₂	Tuning Condenser	R ₂₂	RD 1/8 p 10k ohms 10%
C ₂	Styrol 5 mmfd ±1 mmfd	CV ₂₋₁	Fine Tuning Condenser	R ₂₃	RD 1/8 p 47 ohms 10%
C ₃	Ceramic 0.01 mfd	CV ₂₋₂	Fine Tuning Condenser	R ₂₄	RD 1/8 p 1k ohms 10%
C ₄	Ceramic 0.002 mfd			R ₂₅	RD 1/8 p 2.2k ohms 10%
C ₅	Ceramic 0.01 mfd	D ₁	Diode 1T23	R ₂₆	RD 1/8 p 4.7k ohms 10%
C ₆	Styrol 5 mmfd ±1 mmfd	D ₂	Diode 1T23	R ₂₇	RD 1/8 p 33k ohms 10%
C ₇	Styrol 500 mmfd ±2%	D ₃	Diode 1T23	R ₂₈	RD 1/8 p 5.6k ohms 10%
C ₈	Ceramic 0.001 mfd			R ₂₉	RD 1/8 p 1.2k ohms 10%
C ₉	Styrol 5 mmfd ±1 mmfd	E ₁	Ground Terminal	R ₃₀	RD 1/8 p 2.2k ohms 10%
C ₁₀	Styrol 0.0025 mfd ±2%			R ₃₁	RD 1/8 p 68 ohms 10%
C ₁₁	Ceramic 0.01 mfd	F ₁	Fuse 1 A	R ₃₂	RD 1/8 p 47k ohms 10%
C ₁₂	Electrolytic 40 mfd 10 V	F ₂	Spare Fuse 1 A	R ₃₃	RD 1/8 p 5.6k ohms 10%
C ₁₃	Ceramic 0.02 mfd	F ₃	Spare Fuse 1 A	R ₃₄	RD 1/8 p 22k ohms 10%
C ₁₄	Ceramic 150 mmfd 10%	F ₄	Spare Fuse 1 A	R ₃₅	RD 1/8 p 330 ohms 10%
C ₁₅	Electrolytic 30 mfd 6 V			R ₃₆	RD 1/8 p 1.2k ohms 10%
C ₁₆	Ceramic 0.04 mfd	J ₁₋₁	Plug type "P"	R ₃₇	RD 1/8 p 390 ohms 10%
C ₁₇	Ceramic 2 mmfd ±0.5 mmfd	J ₁₋₂	Jack with DPDT Leaf	R ₃₈	RD 1/8 p 68 ohms 10%
C ₁₈	Ceramic 180 mmfd 10%			R ₃₉	RD 1/8 p 470 ohms 10%
C ₁₉	Ceramic 0.04 mfd	J ₂₋₁	Plug type "P"	R ₄₀	RD 1/8 p 2.4k ohms 10%
C ₂₀	Ceramic 2 mmfd ±0.5 mmfd	J ₂₋₂	Jack with DPDT Leaf	R ₄₁	RD 1/8 p 10 ohms 10%
C ₂₁	Ceramic 0.01 mfd			R ₄₂	RD 1/8 p 120 ohms 10%
C ₂₂	Ceramic 180 mmfd 10%	J ₃₋₁	Connector 3-pin female	R ₄₃	RD 1/8 p 15 ohms 10%
C ₂₃	Electrolytic 30 mfd 10 V	J ₃₋₂	Connector 3-pin male	R ₄₄	Wire-Wound 0.5 ohms ±5%
C ₂₄	Ceramic 0.01 mfd	J ₄₋₁	Alligator Clip, Red	R ₄₅	RD 1/8 p 2.2k ohms ±10%
C ₂₅	Electrolytic 5 mfd 6 V	J ₄₋₂	Alligator Clip, White	R ₄₆	RD 1/8 p 1k ohms ±10%
C ₂₆	Electrolytic 30 mfd 3 V	J ₅₋₁	Connector 4-pin female	RV ₁	Potentiometer 5k ohms A
C ₂₇	Ceramic 0.04 mfd	J ₅₋₂	Connector 4-pin male	RV ₂	Potentiometer 500 ohms B
C ₂₈	Electrolytic 5 mfd 6 V	J ₆₋₁	Connector 4-pin female		
C ₂₉	Electrolytic 30 mfd 10 V	J ₆₋₂	Connector pin male	S ₁	Band Set Switch
C ₃₀	Electrolytic 5 mfd 6 V			S ₂	Micro Switch SPDT
C ₃₁	Electrolytic 30 mfd 10 V	L ₁	MW Antenna Coil	S ₅	Power on/off Switch SPST
C ₃₂	Electrolytic 30 mfd 3 V	L ₂	SW Antenna Coil	S ₆	Monitor speaker Switch SPST
C ₃₃	Electrolytic 5 mfd 6 V	L ₃	MW Oscillator Coil		
C ₃₄	Electrolytic 30 mfd 10 V	L ₄	SW Oscillator Coil	SP ₃	2.5" PM speaker
C ₃₅	Electrolytic 30 mfd 3 V	L ₅	IFT 1	SP ₂	12" Horn Speaker
C ₃₆	Electrolytic 30 mfd 6 V	L ₆	IFT 2	SP ₁	12" Horn Speaker
C ₃₇₋₁	Electrolytic (Block) 500 mfd 10 V	L ₇	IFT 3		
C ₃₇₋₂	Electrolytic (Block) 1,000 mfd 10 V	L ₈	Input Transformer	T ₁	Thermistor
C ₃₈	Electrolytic 30 mfd 6 V	L ₉	Output Transformer		
C ₃₉	Electrolytic 100 mfd 10 V	L ₁₀	RF choke	X ₁	Transistor 2T201
C ₄₀	MP 1 mfd 20% 150V	M ₁	Microphone	X ₂	Transistor 2T76
C ₄₁	Ceramic 0.01 mfd +100% - 0% 50 V	R ₁	RD 1/8 p 10k ohms 10%	X ₃	Transistor 2T76
C ₄₂	Ceramic 0.01 mfd +100% - 0% 50 V	R ₂	RD 1/8 p 1.5k ohms 10%	X ₄	Transistor 2T64
C ₄₃	Ceramic 0.01 mfd +100% - 0% 50 V	R ₃	RD 1/8 p 1k ohms 10%	X ₅	Transistor 2T65
C ₄₄	Polyester 0.01 mfd +100% - 0% 50 V	R ₄	RD 1/8 p 1.5k ohms 10%	X ₆	Transistor 2T65
		R ₅	RD 1/8 p 8.2k ohms 10%	X ₇	Transistor 2T303
		R ₆	RD 1/8 p 2.2k ohms 10%	X ₈	Transistor 2T304
		R ₇	RD 1/8 p 150k ohms 10%	X ₉	Transistor 2T304
		R ₈	RD 1/8 p 68 ohms 10%		
		R ₉	RD 1/8 p 100k ohms 10%		
		R ₁₀	RD 1/8 p 68k ohms 10%		
		R ₁₁	RD 1/8 p 470 ohms 10%		
		R ₁₂	RD 1/8 p 47 ohms 10%		
		R ₁₃	RD 1/8 p 470 ohms 10%		
		R ₁₄	RD 1/8 p 3.3k ohms 10%		
		R ₁₅	RD 1/8 p 33k ohms 10%		



TR-903 Circuit schematic diagram

QUICK GUIDE TO SIMPLE SERVICING

The transistor is a current device. Therefore, basic procedure of analysis of its operation is checking current. In any case, Mili-ammeter connected in series with power source battery will be quite helpful for trouble shooting.

The current for each transistor can be known by calculation from voltage drop across emitter resistor except in case of output stage whose emitter resistor scarcely has sufficient value to produce discernible voltage drop, in general.

Collector current can be considered actually equal to emitter current as base current is extremely small.

Required instruments

- (1) Multi-meter
- (2) Mili-ammeters 100 mA and 1 A
- (3) Signal injector
- (4) Signal generator
- (5) Tools
 - a. Screw driver
 - b. Tweezers
 - c. Wire cutter
 - d. Soldering iron less than 30 Watts

In addition to the mentioned above, VTVM is recommended if available for convenience of Local oscillator voltage adjustment.

No Sound due to troubles after detector stage

- | | |
|---|--|
| No battery current | (1) Worn out battery
All measurement or checking must be performed on specified battery voltage. |
| | (2) Poor battery contact |
| | (3) Defective power switch |
| | (4) Improper soldering on switch terminal |
| | (5) Open circuit in power supplying line |
| Heavy current | (1) Short circuit in power supplying line |
| | (2) Grounded power switch |
| | (3) Short circuit of condenser C_{37-1} or C_{37-2} |
| | (4) Grounded primary coil of Interstage transformer L_3 |
| | (5) Open circuited thermistor Th. |
| | (6) Grounded power supplying line |
| Excessive current | (1) Defective output transistor
Larger I_{co}^* |
| | (2) Short circuit between layers of Interstage or Output transformer
Sometimes Oscillator coil or IF transformer may be included. |
| Mili-ammeter inserted in battery circuit deflects when Tuning condenser is turned with Volume control set at maximum. | (1) Open circuit or short circuit in secondary winding side
Be careful especially of External speaker cable. |
| | (2) Open circuit in Speaker coil |
| No voltage on collector lead of driver or output transistors | (1) Open circuit in primary winding of audio transformer
No voltage on output transistor collector means trouble in Output transformer.
No voltage on driver transistor collector means trouble in Interstage transformer. |
| | (2) Open circuit of resistors in power supplying line. |

- Sound is heard when signal is injected to collector of driver but no sound in case of base.
- (1) Defective driver transistor
- Abnormal emitter voltage of driver
- (1) Trouble in biasing circuit
Check base voltage or bias resistor.
- (2) Defective transistor
If the base voltage and bias resistor show normal value, faulty driver transistor may be suspected.

No sound due to troubles before detector stage

- No sound is heard when signal is injected to primary winding of IFT₃ but audio stages are working normally.
- (1) Defective diode
Normally the resistance of the diode is lower than 300 Ω in forward direction and higher than 50 k Ω in backward direction when measured by VO meter set at RX₁₀ range.
- (2) Open circuit or short circuit between layers in secondary winding of IFT₃.
- (3) Defective by-pass condenser C₂₄.

No sound due to troubles before detector stage

- No voltage on collector of oscillator or IF transistor
- (1) Open circuit in Oscillator transformer or primary winding of IF transformer
- (2) Open resistor in power supplying line, R₁₈ or R₃
- Abnormal emitter voltage of X₂ or X₃
- (1) Check base voltage and biasing resistors
- (2) Defective transistor
If the bias voltage and biasing resistors show normal value, transistor may be suspected.
- No sound is heard when signal is injected to base of X₂ or X₃
- (1) Defective X₂ or X₃
It must be kept in mind that X₃ is affected by X₂ as they are coupled directly.
- (2) Defective resonating condenser C₁₈ or C₂₂

No sound due to troubles in converter stage

- No sound is heard when signal is injected to base of X₁.
- (1) Defective X₁
- No voltage on X₁ collector
- (1) Open circuit in primary winding of Oscillator transformer
- Abnormal voltage or current in X₁
- (1) Open resistor or varied value of resistors
- Abnormal emitter voltage of X₁
- (1) Defective emitter resistor
- (2) Defective emitter by-pass condenser C₄₃ or C₄₆
- No voltage on base of X₁
- (1) Open circuit in Antenna coil L₁ (in case of medium wave)
- (2) Open circuit in Oscillator transformer L₄ (in case of short wave)
- Noise increases by touching base or collector of X₁, with finger, or
- (1) Defective condenser in emitter circuit
- (2) Short circuit between layers of secondary winding of Oscillator transformer
- Remarkable click is heard from the speaker when emitter of X₁ is touched by test lead,
- (3) Short circuit of Tuning condenser
- (4) Open circuit in primary winding of Antenna coil
- Sometimes station is received faintly but not selectable.
- Station is received when antenna side of Tuning condenser is touched with metallic material (like screw driver).

Intermittently no sound or low output

- In most cases, the sound is interrupted or comes out by giving mechanical shock.
- (1) Conductor on the printed circuit board is going to break.
- (2) Poor contact of switches
- (3) Poor contact of battery
- (4) Incomplete conduction of resistor or improper soldering of component